

REMARKS

STATUS OF THE CLAIMS

Claims 1-32 are pending. Claims 22-30 stand withdrawn. Claims 1-21, 31, and 32 stand rejected.

Claims 31 and 32 are amended. Support for the amendments to claim 31 is found in Figs. 2A-2C and the associated Written Description, and in paragraph [0009]. Claim 32 is amended to remove the term "only", which the Examiner raises in the rejections under 35 U.S.C. § 112, ¶1. These amendments do not add new matter. Since the amendment to claim 32 removes the only rejection of claim 32, allowance of claim 32 is respectfully respected.

RESPONSE TO OBJECTIONS

On page 3 of the Office Action, Section 2: Specification, the Examiner states that the amendment filed February 2, 2007 is objected to because it introduces new matter and that "the original disclosure does not support the subject matter now added to paragraph 0030 since the original disclosure fails to suggest, explicitly or implicitly, that no molding compound is introduced in the space 35". The undersigned respectfully traverses. The amendments to paragraph [0030] that have been entered do not add new matter, thus there is no new matter to be cancelled.

Fig. 2A shows molding compound 30 (Written Description, ¶ [0028]), which is indicated with a hatch pattern of alternating thin and thick lines. This hatch pattern is commonly used to indicate a section of synthetic resin or plastic (MPEP, 8th Ed., Rev.2, May 2004, § 608.02, p. 600-99). There is no hatching in the space 35; however, "a pedestal 28 or thermal grease is used to fill the difference in height between the backside of the semiconductor IC and the package lid 10'" (¶ [0031]) is shown with hatching, as are the cross sections of the chip capacitors 36, 38.

The inquiry in this case is what the drawing discloses to one skilled in the art. Whatever it does disclose may be added to the specification in words without violation of the statute and rule which prohibit "new matter," for the simple reason that what is originally disclosed cannot be "new matter". Drawings alone may be sufficient to enable the patent application. *In re Wolfensperger*, 302 F.2d 950, 133 USPQ 537

(C.C.P.A. 1962). If Fig. 2A contains the necessary disclosure, it can form the basis of a valid claim. *Id.* at 542. One of ordinary skill in the art, in view of Fig. 2A and the associated Written Description, would conclude that no molding compound is present in the space 35.

The Applicant further discloses in paragraph [0028] that “Molding compound 30 is applied in a plastic or fluid state to an exposed perimeter portion 32 of the surface of the package substrate 24. The exposed perimeter portion 32 extends from the end of the sloped wall 34 to the edge of the package substrate 24, and hence is exposed to the molding compound.” Similarly, paragraph [0040] states “Molding compound is applied in a plastic or fluid state to the exposed perimeter portion of the package substrate and against the sloped wall of the substrate (step 306), and allowed to harden”. The Applicant yet further discloses in paragraph [0009] that “A vent is optionally provided to allow gases to escape from the interior of the package when the packaged semiconductor is soldered to a printed circuit board.”

Fig. 2B shows vents 42, 42' which would presumably be filled with molding compound if the Examiner's interpretation is adopted; however, the molding compound 30 is clearly demarcated from vent 42 in Fig. 2B. It is not logical to provide a vent to allow gases to escape from the interior of the package when the packaged semiconductor is soldered to a printed circuit board if the interior of the package was filled with molding compound, as urged by the Examiner. The vent 42 is shown to be free of molding compound in Fig. 2B, and the space 35 is also shown to be free of molding compound in Fig. 2A.

The Examiner urges that the disclosure suggests that molding compound is added in the argued space because “paragraph 0030 (of the original specification) discloses that the molding compound is formed on **“about 2 mm to about 3 mm** of the package substrate 24” [emphasis added]. In addition, paragraph 0030 discloses that “[T]he set-back from the edge of the package substrate 24 to the chip capacitors 36, 38 is typically about **2-3 mm**,” which is the same length or region disclosed for the molding compound.”

The Applicant respectfully traverses the Examiner's position and characterization of the disclosure, and respectfully notes that an applicant may

disclose more than one embodiment. The disclosure must be considered as a whole, as it would be considered by one of ordinary skill in the art. Paragraph [0030] states "Chip capacitors 36, 38 are frequently mounted on the package substrate 24 around the perimeter of the semiconductor IC 26. The set-back from the edge of the package substrate 24 to the chip capacitors 36, 38 is typically about 2-3 mm in some embodiments", and "In a particular embodiment, about 2 mm to about 3 mm of the perimeter of the package substrate 24 was exposed in the areas with molding compound 30."

The Examiner is combining selected portions of two different possible embodiments. One embodiment may have the disclosed capacitor set-back, and another embodiment may have a 2-3 mm exposed perimeter with a greater capacitor setback. It is not necessary to combine both features into a single embodiment, and such combination is contrary to the disclosure when considered as a whole.

On page 3 of the Office action, the Examiner provided the figure reproduced below:

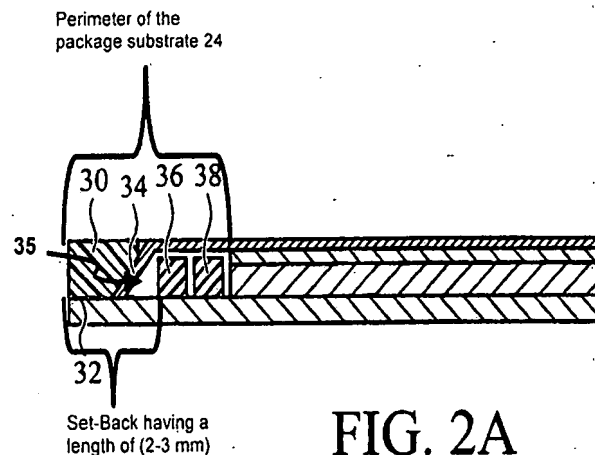


FIG. 2A

Paragraph [0028] of the Written Description states that "Molding compound 30 is applied in a plastic or fluid state to an exposed perimeter portion 32 of the surface of the package substrate 24. The exposed perimeter portion 32 extends from the end of the sloped wall 34 to the edge of the package substrate 24, and hence is exposed to the molding compound." The Examiner defines a "Perimeter of the package substrate" in a manner that is inconsistent with both the Written Description and Figs. 2A - 2C, which show molding compound only on the exposed perimeter 32 of the substrate 24,

and not within the space 35. If the space 35 were filled with molding compound, which it is not, it would be filled with the same hatch pattern used for the molding compound 30. The Examiner's definition of the perimeter of the package substrate and his conclusion that molding compound is also present in the space 35 is contrary to the disclosure and is not what one of ordinary skill in the art would conclude.

One of ordinary skill in the art, considering the disclosure in its entirety and as a whole, would conclude that molding compound is applied on the exposed perimeter portion of the package substrate to contact an exterior surface of the sloped wall, and that the space 35 would not be filled with molding compound, as urged by the Examiner.

The "proposed figures are objected to since the cross sectional view as shown in figure 2A does not correspond to the cross section taken along the proposed line A-A in figure 2B." The undersigned thanks the Examiner for identifying this error, and Fig. 2B is corrected accordingly in the attached replacement sheet of drawings. The regions of molding compound 30, 30', 40, 40' in Fig. 2B are corrected to extend to the top of the sloped wall 34, as shown in Fig. 2A. The attached replacement sheet does not add new matter because one skilled in the art would not only recognize both the existence of the error and the appropriate correction (see, *In re Oda*, 443 F.2d 1200, 170 USPQ 260 (CCPA 1971)), and also because Fig. 2A shows the molding compound extending to the top of the sloped wall 34.

In reviewing the drawings, it was noted that Fig. 2A also contains a minor error. Paragraph [0027] states that "Fig. 2A is a simplified cross section of the package lid 10' of Fig. 1C assembled to a package substrate 24." The package lid shown in Fig. 1C does not have a rim (compare Fig. 1A, ref. num. 20). Fig. 2A is corrected to conform to the lid of Fig. 1C as shown in the attached replacement sheet of drawings.

The drawings are objected to "because the disclosure fails to describe the "space" or "gap" that is enclosed by package lid 10, substrate 24 and semiconductor IC 26; and that surrounds chips 36 and/or 38 [see figures 2A and 2C]" (Office Action, page 4, ¶1). The Applicant respectfully traverses. Figs. 2A and 2C each show a space (e.g. Fig. 2A, ref. num. 35) enclosed by the package lid. Information contained in any one of the specification, claims or drawings of the application as filed may be

added to any other part of the application without introducing new matter (MPEP 2163.06). “[D]rawings alone may provide a written description of an invention as required by § 112. . . . Drawings constitute an adequate description if they describe what is claimed and convey to those of skill in the art that the patentee actually invented what is claimed” (*Cooper Cameron Corp. v. Kvaerner Oilfield Prods.*, 291 F.3d 1317, 62 USPQ2d 1846, 1850 (Fed. Cir. 2002); see also, *Vas-Cath, Inc. v. Mahurkar*, 935 F.2d 1555, 19 USPQ2d 1111 (Fed. Cir. 1991).

Furthermore, as noted on page 2 of the Office action, the amendments to the written description filed on February 2, 2007 have been entered. Thus, the specification also contains a written description of the gap 35 in paragraph [0030]. Reconsideration and removal of the objections to the drawings is respectfully requested.

REQUEST FOR CORRECTION OF THE STATEMENT OF THE SUBSTANCE OF THE INTERVIEW

In the Advisory Action mailed /1/23/2007, the Examiner requests correction of the Statement of the Substance of the Interview for the telephonic interview conducted on November 30, 2006. The undersigned requests the Statement of the Substance of the Interview be corrected to delete all language indicating that the Examiner made any suggestions regarding changes to the application. Various changes to the application were discussed for inclusion in the response for the Examiner to consider after receiving the Applicant’s written response.

REJECTIONS UNDER 35 U.S.C. § 112

Claims 1-21, 31, and 32 are rejected under 35 U.S.C. § 112, ¶1, “because the specification, while being enabling for forming the molding compound on the exterior surface of the sloped wall, does not reasonably provide enablement for the use of the term “only” as recited in the amended claims” (Office Action, page 5, ¶1). Claims 31 and 32 are amended to remove the offending term, rendering their rejection moot and placing claim 32 in condition for allowance.

Regarding claims 1-21, the Applicant respectfully traverses. Fig. 2A shows molding compound 30 on the exposed perimeter 32 and sloped wall 34, and not within the space 35. Fig. 2B shows molding compound 30, 30', 40, 40' on opposite sides of the package lid 10', and not within the vents 42, 42' or even along the top and bottom edges of the packaged semiconductor 44, as described in paragraph [0032].

Fig. 2A contains the necessary disclosure to form the basis of claim 1. Further enablement is found in paragraphs [0010], [0028], [0032], and [0040] (Fig. 3, step 306), which indicate that molding compound is applied to or formed against the package substrate and sloped wall of the package lid. The Applicant does not disclose that molding compound is within the lid, and such a notion is strained and unreasonable when the disclosure is considered as a whole.

The Examiner further states that "the disclosure fails to describe how the chips (36) and (38), and the interior walls of the package lid (10) are protected from being encapsulated with molding compound (30), especially when vents or holes are provided on the package lid (10) [see paragraphs 0025 and 0026 in applicant's specification]. Please note that these holes or vents inherently allow air and/or the molding compound to pass through the package lid to form an encapsulant for enclosing an "internal" chip".

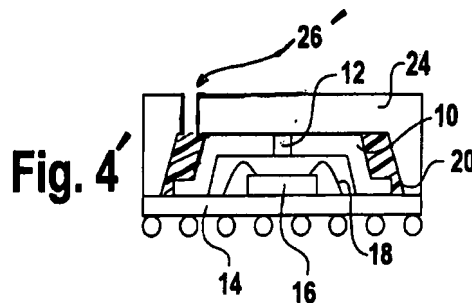
The Applicant respectfully notes that independent claim 1 does not recite a vent. Paragraph [0023] states that a vent is optional. If an embodiment does not have a vent, then molding compound could not pass through the vent to form an encapsulant for the internal chip.

The Examiner has not provided a sufficient basis in fact or technical reasoning to reasonably support the contention that the molding compound would necessarily (i.e., inherently) pass through the package lid "to form an encapsulant enclosing the "internal" chip" (see, *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990)), and therefore has not established a *prima facie* case.

Even for embodiments including a vent, if one had a syringe dispenser full of fluid molding compound and applied a bead of molding compound to the exposed perimeter portion of the package substrate (ref., *Total Dispensing Solutions*, published by Asymtek (Spring 1998), filed as Exhibit A with the submission on February 2, 2007,

describing an automatic encapsulant dispensing system using dispensing tips and camera system for “precise positioning of dispensing point”), or applied molding compound in a plastic state to the exposed perimeter portion, say by pressing it into place with a simple tool or even using only the fingers, and then the molding compound was cooled, cured, or otherwise hardened (see Fig. 3 and the associated Written Description), would molding compound inherently fill the lid? Of course not.

In the submission filed February 2, 2007, the Applicant provided an example of how to avoid passing molding compound through a vent in a heat spreader of a prior art device by using a simply modified mold form, which is reproduced below and is modified from Fig. 4 of U.S. Patent No. 6,654,248 by Fishley:



Similarly, U.S. Patent No. 6,246,115 B1 by Tang et al. discloses techniques for applying molding compound to selected regions, in particular, “to prevent the encapsulating resin from flashing over the top surface 322 of the heat sink 32” (Col. 5, lines 31-32). Techniques for confining molding compound to selected areas were known, and one of ordinary skill in the art would recognize the enablement of claim 1 in the as-filed application.

Even though no *prima facie* case has been established, the Applicant has provided evidence that has been entered into the file history, including reference to prior art that shows selective application of molding compound to select regions, that the Examiner has not addressed, rebutted, or overcome. Reconsideration and removal of the remaining rejections under 35 U.S.C. § 112, ¶1 is respectfully requested.

REJECTIONS UNDER 35 U.S.C. § 102

The Examiner states that, “[a]s far as understood, claims 1, 3-5, 7-10, 15, 19, 21 and 31 remain rejected under 35 U.S.C. § 102(a,e) as being anticipated by U.S. Patent No. 6,654,248 B1 by Fishley (hereinafter “Fishley”). Pending claim 1 recites, among other elements, “molding compound contacting only an exterior surface of the sloped wall so as to secure the package lid to the package substrate”. All language of a claim must be considered. The Examiner appears to not have considered claim 1 in its entirety because Fishley discloses filling the heat spreader 10 with molding compound 20 through the aperture 12 in the heat spreader and top gap 26 in the mold form 24 to encapsulate the IC 16.

Furthermore, the heat spreader 10 is not a package lid and Fishley does not use the heat spreader 10 as a lid, but rather relies on encapsulating the device in molding compound, apparently both filling and surrounding the heat spreader with molding compound, thus teaching away from claim 1. Fishley does not place claim 1 in possession of the public, and does not anticipate claim 1. A *prima facie* case of anticipation of claim 1 has not been established. Claim 1 and all claims that depend from claim 1 are allowable.

Amended claim 31 recites a packaged semiconductor comprising, among other elements, “means for securing the package lid to the package substrate by applying molding compound to external portions of the sloped wall of the package lid and the exposed perimeter portion of the package substrate so as to leave a space within the packaged semiconductor not filled with molding compound; and means for venting gases from the space when the packaged semiconductor is soldered to a printed circuit board.”. Fishley discloses flowing molding compound through a central aperture in a heat sink to encapsulate an integrated circuit and bonding wires. Fishley discloses encapsulating the IC within the heat spreader by flowing molding compound through the aperture 12. Presumably, the aperture 12 of Fishley would then be plugged by molding compound and would not operate as a vent allowing gases to escape during assembly of the packaged semiconductor to a printed circuit board. Similarly, it seems more likely than not that, if the heat spreader 10 is filled with molding compound to encapsulate the IC, secure the bond wires, and dissipate

thermal energy generated in the IC (Col. 4, lines 18-28), there would be no gases to vent when the packaged IC of Fishley is assembled on a printed circuit assembly. Fishley does not disclose or suggest claim 31, and claim 31 is patentable.

Claim 9, which depends from claim 1, further recites “a vent allowing gases to escape during assembly of the packaged semiconductor to a printed circuit assembly.” Fishley discloses encapsulating the IC within the heat spreader by flowing molding compound through the aperture 12. Presumably, the aperture 12 of Fishley would then be plugged by molding compound and would not operate as a vent allowing gases to escape during assembly of the packaged semiconductor to a printed circuit assembly. Similarly, it seems more likely than not that, if the heat spreader 10 is filled with molding compound to encapsulate the IC, secure the bond wires, and dissipate thermal energy generated in the IC (Col. 4, lines 18-28), there would be no gases to vent when the packaged IC of Fishley is assembled on a printed circuit assembly. Fishley teaches away from claim 9. One of ordinary skill in the art would not consider the aperture of Fishley to be a vent allowing gases to escape during printed circuit assembly because the packaged device of Fishley would be filled with molding compound at circuit assembly. Fishley does not disclose or suggest claim 9, and claim 9 and all claims that depend from claim 9 are further patentable.

Claim 10, which depends from claim 9, recites that “the vent is provided in a side of the package lid.” The Examiner states that “Fishley et al. further teaches a vent (12) provided on the top side of the package lid (10) [see fig. 3].” The Applicant respectfully traverses the Examiner’s position. Fishley does not disclose any vent and cannot disclose a vent in a side of the package lid.

The Examiner’s characterization of the aperture 12 of Fishley as being on a “top side” of the package lid is strained, unreasonable, and inconsistent with how one of ordinary skill in the art would interpret claim 10. FIG. 1A of the instant patent application shows a top 18 of a package lid 10, and distinguishes the top 18 from a side of the package lid in paragraph [0023]. Similarly, Fishley describes a top gate 26 through which molding compound flows through the centrally disposed aperture 12 (Col. 4, lines 41-43). The Examiner’s characterization eviscerates the long-standing principle of claim differentiation, namely the differentiation between a top and a side.

One of ordinary skill in the art, considering claim 10, the Applicant's disclosure, and the disclosure of Fishley as wholes, would not consider the aperture 12 of Fishley to be a vent in a side of a package lid.

Fishley teaches away from providing an aperture in the side of the package lid "because the molding compound . . . flowing radially outward from the top center of the package . . . does not sweep the wires into one another" (Col. 2, lines 45-48). An aperture in the side of the heat spreader 10 of Fishley would not flow the molding compound radially outward from a central location to avoid wire sweep. Fishley does not teach or suggest claim 10, and claim 10 and all claims that depend from claim 10 are further patentable,

Claims 1, 3, 9-15, 19 and 21 stand rejected under 102(b) as being anticipated by U.S. Patent No. 6,246,115 B1 by Tang et al. (hereinafter "Tang"). Pending claim 1 recites, among other elements, "molding compound contacting only an exterior surface of the sloped wall so as to secure the package lid to the package substrate". The integrated circuit of Tang is shown as being filled with encapsulating resin 33 and contacting interior surfaces of the heat sink 32. Tang does not disclose all elements of claim 1 arranged as recited in claim 1. No *prima facie* case of anticipation has been established and claim 1 is allowable.

Claim 9, which depends from claim 1, further recites "a vent allowing gases to escape during assembly of the packaged semiconductor to a printed circuit assembly." The Examiner states that "Tang et al. teaches a vent (326, 321a) allowing gases to escape during assembly of the packaged semiconductor to a printed circuit assemble [see figs. 1-2]. In Figs. 1 and 2, Tang shows both the opening 326 and the hole 321a as being filled with encapsulant 33. Neither of these features cannot operate as a vent allowing gases to escape during assembly of the packaged semiconductor to a printed circuit assembly because they are plugged with encapsulant and would not allow gases to escape during assembly of the packaged semiconductor to a printed circuit assembly even if there were gases to escape. However, as seen in Fig. 2 of Tang, the interior of the integrated circuit package is filled with encapsulant 33. There are no gases to vent during assembly of the integrated circuit package of Tang to a printed circuit, and no reason to even provide a vent. Tang teaches away from claim 9. Tang

does not disclose or suggest claim 9, and claim 9 and all claims that depend from claim 9 are further patentable.

Claim 10, which depends from claim 9, recites that "the vent is provided in a side of the package lid." Tang does not disclose any vent and cannot disclose a vent in a side of the package lid. Claim 10 is further patentable and claim 11, which depends from claim 10, is also patentable.

Claim 13, which depends from claim 12, further recites "fiducial marks formed in the rim." The Examiner states Tang "teaches fiducial marks (consider protrusion P1 or 325) formed in the rim (V1) [see fig. 2, attached above]." The Applicant cannot find a fig. 2 in the Office action showing these features and will respond as far as understood. Tang describes element 325 as a positioning tongue (Col. 5, line 47) having a curved edge 325a; however, the positioning tongue 325 is not formed in the rim, but rather extends beyond the rim. Tang states that injection pins 51 in a mold penetrate the openings 326 on the four corners of the heat sink 32 in order to keep the heat sink in position (Col. 4, lines 64-67); thus teaching away from fiducial marks formed in the rim. Claim 13 is further patentable.

REJECTIONS UNDER 35 U.S.C. § 103

Claims 2, 6, 11-14, 16, and 17 stand rejected as being unpatentable over Fishley in view of Tang. To establish a *prima facie* case of obviousness, the prior art references must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. The Examiner may not use the Applicant's disclosure as a template to re-construct the rejected claim from selected elements of the prior art.

Claim 11, which depends from claim 1 through claims 9 and claim 10, recites that the vent comprises a gap in the sloped wall. The Examiner acknowledges that Fishley fails to teach a gap in the sloped wall, and asserts that Tang "shows a gap (321a) in the sloped wall (321) of the package lid (32)." The Applicant respectfully traverses the Examiner's position.

Each reference must be taken as a whole, including where the references diverge and teach away from the claimed invention. Tang states that "the supportive legs **321** are each formed with a through hole **321a**" (Col. 5, lines 6-7). FIG. 2 of Tang shows these holes **321a** being surrounded and plugged with encapsulant **33**. Tang teaches away from claim 11 because one of ordinary skill in the art, considering the Applicant's disclosure, Tang, and claim 11 as wholes, would not consider the plugged holes in the packaged IC of Tang to be vents as defined in claim 9.

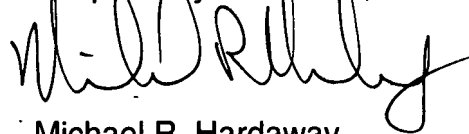
The Examiner urges that one would have been motivated to include a gap in the sloped wall of the package lid of Fishley "to enforce the bonding between the package lid and the encapsulant", thereby confirming that this feature is not a vent. The urged combination of references does not disclose or suggest all elements of claim 11. The Examiner has not provided any motivation for why one of ordinary skill in the art would modify Fishley to include the further limitations recited in claims 12-14. Therefore, each of claims 11-14 is further patentable.

CONCLUSION

All claims are now in condition for allowance and a Notice of Allowance is respectfully requested.

If there are any questions, the Applicants' attorney can be reached at Tel: (408) 879-6149.

Respectfully Submitted,



Michael R. Hardaway
Attorney of Applicants
Reg. No.: 52,992

I hereby certify that this correspondence is being deposited with the United States Postal Service as first-class mail in an envelope addressed to: Commissioner for Patents, P.O. BOX 1450, Alexandria, VA 22313-1450, on May 31, 2007.

Julie Matthews
Name


Signature

AMENDMENTS TO THE DRAWING FIGURES

Fig. 2B is amended to correct Fig. 2B so that it conforms with Fig. 2A and the written description. Fig. 2A is amended to conform Fig. 2A to Fig. 1C and paragraph [0027] of the Written Description.

A Replacement Sheet of Figs. 2A, 2B, and 2C is attached.